

SA 7

1. An imaging system for imaging a target in three dimensions, the system comprising:
 - 5 a light projection source for projecting a beam of light onto the target; - an image acquisition subsystem for acquiring at least two images from light reflected by the target; - a correlation processor for processing the acquired images according to a sparse array image correlation process.
- 10 2. The imaging system of Claim 1 wherein the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis and wherein the aperture element includes an opening offset from the optical axis and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired
15 sequentially from different angles.
3. The imaging system of Claim 1 wherein the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis and wherein the aperture element comprises three optical shutters offset from the optical axis and the image acquisition subsystem further includes switching means for
20 sequentially switching on the optical shutters such that three images are acquired sequentially from different angles.
4. The imaging system of Claim 3 wherein the optical shutters comprise ferroelectric liquid crystal optical shutters.

50
A-7

The imaging system of Claim 1 wherein the subsystem comprises a lens, an aperture element and a camera disposed along an optical axis and wherein the camera includes a single CCD element.

6. The imaging system of Claim 1 wherein the light projection source includes a
5 diffuser for projecting a beam of light having a random pattern.
7. An imaging method for imaging a target in three dimensions, the method comprising:
- 10 projecting a beam of light onto the target;
acquiring at least two images from light reflected by the target through a
lens, an aperture element and a camera disposed along an optical axis;
processing the acquired images according to a sparse array image
correlation process.
8. The imaging method of Claim 7 wherein the aperture element includes an
15 opening offset from the optical axis and acquiring further includes rotating the
aperture element about the optical axis such that the at least two images are
acquired sequentially from different angles.
9. The imaging method of Claim 7 wherein projecting includes projecting a beam
of light having a random pattern.

004720" 9099T960

10. In an imaging system having a lens, an aperture element and a camera disposed along an optical axis, an imaging method for imaging a target in three dimensions, the method comprising:
- projecting a beam of light onto the target;
 - 5 rotating the aperture element such that an opening of the aperture element offset from the optical axis is set to a first position;
 - acquiring a first image at the camera from light reflected by the target through the lens and the aperture opening at the first position;
 - rotating the aperture element such that an opening of the aperture element offset from the optical axis is set to a second position;
 - 10 acquiring a second image at the camera from light reflected by the target through the lens and the aperture opening at the second position;
 - processing the acquired images according to an image correlation process to resolve three dimensional components of the target.
- 15 11. The imaging method of Claim 10 wherein the processing includes processing the acquired images according to a sparse array image correlation process.
12. The imaging method of Claim 11 wherein the sparse array image correlation process includes forming first and second image arrays of pixel values from the respective first and second images, each pixel value associated with one of a
- 20 number of pixels, selecting pixel values in the image arrays which are beyond a pixel threshold value, and performing a correlation process on the selected pixel values comprising creating first and second sparse image arrays of the selected pixel values and their locations in the respective first and second image arrays, performing individual correlations successively between pixel entries of the first
- 25 sparse image array and pixel entries of the second sparse image array within a

0050.2015-000

pixel distance of each other, and cumulating the correlations in a correlation table at respective distance entries.

13. The imaging method of Claim 11 wherein the processing further includes recursive correlation.

5 14. The imaging method of Claim 13 wherein the processing further includes correlation error correction.

15. The imaging method of Claim 14 wherein the processing further includes sub-pixel resolution processing.

10 16. An imaging system for imaging a target in three dimensions, the system comprising:
a light projection source for projecting a beam of light onto the target;
an image acquisition subsystem for acquiring at least two images from light reflected by the target, the subsystem comprising a lens, an aperture element and a CCD element disposed along an optical axis wherein the aperture
15 element includes an opening offset from the optical axis and the image acquisition subsystem further includes rotation means for rotating the aperture element about the optical axis such that the at least two images are acquired at the CCD element sequentially from different angles;
a correlation processor for processing the acquired images according to
20 an image correlation process.

0050.2015-000

- 004T20"9099T960
17. The imaging system of Claim 16 wherein the correlation processor provides processing of the acquired images according to a sparse array image correlation process which comprises forming first and second image arrays of pixel values from respective first and second images, each pixel value associated with one of a number of pixels, selecting pixel values in the image arrays which are beyond a pixel threshold value, and performing a correlation process on the selected pixel values comprising creating first and second sparse image arrays of the selected pixel values and their locations in the respective first and second image arrays, performing individual correlations successively between pixel entries of the first sparse image array and pixel entries of the second sparse image array within a pixel distance of each other, and cumulating the correlations in a correlation table at respective distance entries.
18. The imaging system of Claim 16 wherein the correlation processor provides processing that includes recursive correlation.
19. The imaging system of Claim 16 wherein the correlation processor provides correlation error correction.
20. The imaging system of Claim 16 wherein the correlation processor provides sub-pixel resolution processing.